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SERIES 10

Series 10

MULTIMETERS

Service Manual

FLUKE®

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Series 10

MULTIMETERS

Service Manual

PN 900824
March 1992 Rev. 1, 7/93

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MULTIMETER SAFETY

The Fluke 10, 11, 12 Multimeters have been designed and tested according to IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus. This manual contains information and warnings which must be followed to ensure safe operation and retain the meter in safe condition. Use of this equipment in a manner not specified herein may impair the protection provided by the equipment.

These multimeters comply with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) these multimeters may not cause harmful interference, and (2) these multimeters must accept any interference received, including interference that may cause undesired operation.

Some common international electrical symbols used in this manual are shown below.

~	AC – ALTERNATING CURRENT	ϟ	DANGEROUS VOTLAGE
⎓	DC – DIRECT CURRENT	⏚	EARTH GROUND
≂	EITHER AC OR DC CURRENT	⚠	SEE EXPLANATION IN MANUAL
⎯▭⎯	FUSE	⧈	DOUBLE INSULATION FOR PROTECTION AGAINST ELECTRIC SHOCK

Before using the meter, read the following safety information carefully. In this manual, "WARNING," is reserved for conditions and actions that pose hazard(s) to the user; "CAUTION," is reserved for conditions and actions that may damage your meter.

- Avoid working alone.
- Follow all safety procedures for equipment being tested.
- Inspect the test leads for damaged insulation or exposed metal. Check test lead continuity. Damaged leads should be replaced.
- Be sure the meter is in good operating condition.
- Select the proper function for your measurement.
- To avoid electrical shock, use caution when working above 60V dc or 30V ac RMS.
- Disconnect the live test lead before disconnecting the common test lead.
- Disconnect the power and discharge high-voltage capacitors before testing in Ω and →|·)))|.
- When making a current measurement, turn the circuit power off before connecting the meter in the circuit.
- Check meter fuses before measuring transformer secondary or motor winding current. An open fuse may allow high voltage build-up, which is potentially hazardous.
- Use clamp-on probes when measuring circuits exceeding 10 amps.
- When servicing the meter, use only the replacement parts specified.
- Do not allow meter to be used if it is damaged or if its safety is impaired.

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Section 1
Introduction and Specifications

INTRODUCTION 1-1.

WARNING

SERVICE PROCEDURES DESCRIBED HEREIN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, PERFORM ONLY THOSE SERVICE PROCEDURES IN THIS INSTRUCTION SHEET.

The 10 Series Service Manual provides the information necessary to service the Fluke Model 10, Model 11, and Model 12 Multimeters. The following information is provided in this publication:

- Specifications (Section 1)
- Basic theory of operation (Section 2)
- Disassembly and reassembly (Section 3)
- Performance tests (Section 3)
- Calibration (Section 3)
- Illustrated parts lists and schematic diagram (Section 4)

Refer to the Users Manual for operating instructions.

SPECIFICATIONS 1-2.

Specifications are in Table 1-1. Accuracy is specified for a period of one year after calibration, at 18°C to 28°C (64°F to 82°F) with relative humidity to 90%. AC conversions are ac-coupled, average responding, and calibrated to the rms value of a sine wave input.

Accuracy specifications are given as:

±([% of reading] + number of least significant digits])

Table 1-1. Specifications

Maximum Voltage Between any Terminal and Earth Ground	600V rms
Display	3 3/4-digits, 4000 counts, updates 4/sec
Operating Temperature	-10°C to 50°C
Storage Temperature	-30°C to 60°C indefinitely (to -40°C for 100 hrs)
Temperature Coefficient	0.1 x (specified accuracy)/°C (<18°C or >28°C)
Relative Humidity	0% to 90% (-10°C to 35°C) 0% to 70% (35°C to 50°C)
Battery Type	9V, NEDA 1604 or IEC 6F22
Battery Life	650 continuous hours with alkaline 450 continuous hours with carbon-zinc
Shock, Vibration	1 meter shock. Per MIL-T-28800D for a Class 3 Instrument
Size (HxWxL)	1.35 in x 2.75 in x 5.55 in (3.46 cm x 7.05 cm x 14.23 cm)
Weight	10 oz (286 g)
Safety	Designed to Protection Class II requirement of UL1244, ANSI/ISA-S82, CSA C22.2 No 231, and VDE 0411, and IEC 1010 overvoltage category III.
EMI Regulations	Complies with FCC Part 15, Class B, and VDE 0871B.

Function	Range	Resolution	Accuracy (50 to 400 Hz)	
			Model 10	Models 11/12
Volts AC	4000 mV*	1 mV	±(2.9%+3)	±(1.9%+3)
	4.000V	0.001V	±(2.9%+3)	±(1.9%+3)
	40.00V	0.01V	±(2.9%+3)	±(1.9%+3)
	400.0V	0.1V	±(2.9%+3)	±(1.9%+3)
	600V	1V	±(2.9%+3)	±(1.9%+3)
Volts DC	4000 mV*	1 mV	±(1.5%+2)	±(0.9%+2)
	4.000V	0.001V	±(1.5%+2)	±(0.9%+2)
	40.00V	0.01V	±(1.5%+1)	±(0.9%+1)
	400.0V	0.1V	±(1.5%+1)	±(0.9%+1)
	600V	1V	±(1.5%+1)	±(0.9%+1)
Resistance	400.0Ω	0.1Ω	±(1.5%+2)	±(0.9%+2)
	4.000 kΩ	0.001 kΩ	±(1.5%+1)	±(0.9%+1)
	40.00 kΩ	0.01 kΩ	±(1.5%+1)	±(0.9%+1)
	400.0 kΩ	0.1 kΩ	±(1.5%+1)	±(0.9%+1)
	4.000 MΩ	0.001 MΩ	±(1.5%+1)	±(0.9%+1)
	40.00 MΩ	0.01 MΩ	±(1.9%+3)	±(1.5%+3)
Capacitance	1.000 µF	0.001 µF	NA	±(1.9%+2)
	10.00 µF	0.01 µF	NA	±(1.9%+2)
	100.0 µF	0.1 µF	NA	±(1.9%+2)
	1000 µF	1 µF	NA	±(1.9%+2)
	10000 µF	10 µF	NA	±(10%+90) Typical
Continuity/ Diode Test	2.000V	0.001V	±(1.5%+2)	±(0.9%+2)**

* The 4000 mV range can only be entered in the manual range mode. Use the 4000 mV range with accessories.

** The beeper is guaranteed to come on at <25Ω and turn off at >250Ω. The meter detects opens or shorts of 250 us or longer.

Table 1-1. Specifications (cont)

Function	Overload Protection*	Input Impedance (Nominal)	Common Mode Rejection Ratio (1kΩ Unbalance)	Normal Mode Rejection
Volts DC	600V rms	>10 MΩ <100 pF CHEK & LoZ = >2 kΩ <200 pF**	>100 dB at dc, 50 Hz, or 60 Hz	>50 dB at 50 Hz or 60 Hz
Volts AC	600V rms	>5 MΩ <100 pF CHEK & LoZ = >2 kΩ <200 pF** (ac-coupled)	>60 dB, dc to 60 Hz	

Resistance		Open Circuit Test Voltage	Full Scale Voltage To 4.0 MΩ	Full Scale Voltage 40 MΩ	Short Circuit Current
	600V rms	<1.5V dc	<450 mV dc	<1.5V dc	<500 uA
Diode	600V rms	2.4-3.0V dc	2.400V dc		0.95 mA typical

* 3×10^6 V Hz Maximum

** Models 11 and 12 only.

MIN MAX Recording Accuracy and Response Time (Model 12 Only)

Specified accuracy of the measurement function ± 12 digits for changes >200 ms in duration (±40 digits in ac). Typical 100 ms response to 80%.

MIN MAX Recording with Elapsed Time (Model 12 Only)

Elapsed Time	Resolution	Accuracy
0 to 100 hours (99:59)	1 minute	0.3% typical

Continuity Capture (Model 12 Only)

Detects opens or shorts of 250 µs or longer.

Section 2
Theory of Operation

INTRODUCTION 2-1.

Section 2 provides a basic theory of operation for the Series 10 Multimeters. Electrical components on the printed circuit assembly (A1 Main PCA) are listed in Table 2-1. Refer to Figure 4-2 for the location of these components and Figure 4-3 thru 4-5 for the schematic diagram.

THEORY OF OPERATION 2-2.

The analog/digital IC (U1) implements the electrical measurement functions. See Table 2-2 for pin names and descriptions. The microcomputer (U2) controls U1, the LCD (U3), and the user interface. Discrete components support U1 and U2, provide reference standards for measurements, and provide input overload protection.

Analog Measurement IC (U1) 2-3.

U1 implements the following analog functions: a/d converter, ac to dc converter, VCHEK circuitry (Models 11 and 12 only), active filter, passive filter, power supply, range configuration circuitry, signal routing circuitry, beeper driver, digital control circuitry, and digital U2 interface circuitry.

The a/d converter is a patented dual-rate, dual-slope converter. The dual-rate conversion allows for MIN MAX (Model 12 only) and fast autoranging functions. The ac to dc converter is full-wave rectified and average-responding. The active and passive filters are two-pole and one-pole low-pass filters (respectively) that are used for signal filtering prior to a/d conversion. The internal power supply generates a ground voltage nominally +3V relative to VSS. Range configuration circuitry connects the Z1 resistor network as needed for different ranges. Routing circuitry connects the various signal conditioning circuits as needed. The a/d converter and a counter are controlled by a state machine. Finally, digital circuitry interfaces with U2 via a parallel address and bidirectional data bus.

Voltage is measured using a ratio comparison of the unknown voltage to the reference voltage (REFI pin). Resistance is calculated using a ratio comparison of the voltage across the unknown resistor to the voltage across a precision reference resistor, with the same current in both. Capacitance is measured by determining the amount of charge added for a given dc voltage change.

Microcomputer IC (U2) 2-4.

U2 writes range settings and a/d converter information to U1. U2 reads a/d converter results and status information. This includes the low battery check, slide-switch position, continuity check, and VCHEK data. The microcomputer performs math operations on the raw data from U1 and configures it for the LCD. U2 also reads pushbutton inputs. Finally, the 2.1 MHz clock signal at U2 is divided down to 131 kHz and sent to U1 (CLK pin) for the counter.

VCHEK™ Input Resistance 2-5.

As shown in Figure 2-1, the input resistance for the VCHEK function is non-linear. The data in the graph are for the volts dc function (any range) and are the steady state values obtained after the PTC thermister (RT1) has stabilized. The data also apply for the volts ac function.

Table 2-1. Electrical Components on Main PCA

Circuit and Function	Component Designator(s)
Analog Measurement IC	U1
Microcomputer IC	U2
Input Divider and Ohms Reference Resistor Network	Z1
Input Divider AC Coupling Capacitor	C14
J2 Input Receptacle Voltage Sense Resistor	R17
J1 Input Receptacle Voltage Sense Resistor	R14
Reference Voltage for Volts Measurements	VR1, R4, R5, R6, R26
A/D Converter Integrate Capacitor	C2
A/D Converter Autozero Capacitor	C1
A/D Converter Gain Resistors	R1, R3, R15
Active Filter Components	R7, R8, C5, C6
Passive Filter Components	R9, C7
AC to DC Converter Gain Resistors	R11, R12, R13
AC to DC Converter AC Coupling Capacitor	C8
Bias Current Setting Resistor	R2
DGND-VSS Voltage Setting Resistors	R10, R24
Power Supply Bypass Capacitors	C3, C15
Reverse Battery Protection	CR1
System Clock	Y1
VCHEK Input Current Limiters	R16, R18, R29
VCHEK Input Positive Temp. Coef. Thermistor	RT1
VCHEK Input Voltage Clamp Circuit	Q1, Q2, CR2, R28
VCHEK Input Fusible Resistor	R19
Microcomputer Reset Circuit	R23, R25, C10, C13, CR3
On/Off and VCHEK Select Slide Switch	S1
Beeper	LS1
Beeper Current Limiter	R22
Slide Switch Protection	E1
Switch Sense Bypass Capacitor	C9
Input Divider Bypass Capacitor	C16
Zero Ohm Jumpers	R20, R21, R27

Table 2-2. U1 Pinout Table

Pin No.	Pin Name	Description
1	READ(L)	When low (VSS), data from addressed register can be read.
2	ADR5	Most significant address bus line.
3	ADR4	Bit 4 of parallel address bus.
4	ADR3	Bit 3 of parallel address bus.
5	ADR2	Bit 2 of parallel address bus.
6	ADR1	Bit 1 of parallel address bus.
7	ADR0	Least significant address bus line.
8	VSS	Negative power supply voltage (-3V relative to DGND).
9	VDD	Positive power supply voltage for analog only (Vbat-3V=VDD-DGND).
10	K0	1st a/d gain resistor pin, generally for de-integrate.
11	K1	2nd a/d gain resistor pin, generally for integrate.
12	K2	3rd a/d gain resistor pin, for autozero.
13	AZ	A/D converter pin for autozero capacitor.
14	INT	A/D converter pin for integrator capacitor.
15	REFI	1.00V reference voltage for de-integrate signal in volts.
16	BIAS	Pin for analog bias current generator reference resistor.
17	REFH	Connects 1.235V reference voltage to on-chip circuits.
18	BGND	Not used.
19	AFO	Active filter high output pin (2-pole, low-pass filter).
20	FAO	Internal active filter node.
21	FAI	Internal active filter node.
22	AFI	Active filter high input pin.
23	VSS	Negative power supply voltage (-3V relative to DGND).
24	PFO	Passive filter low output pin (1-pole, low-pass filter).
25	AVAOM	Absolute value amp (full wave rectified) negative output pin.
26	AVAOP	Absolute value amp (full wave rectified) positive output pin.
27	AVAM	Absolute value amp inverting input (summing node).
28	ACBO	AC buffer output.
29	VSET	Voltage divider sense for power supply.
30	PSTEST	Pin to disable on-chip power supply for U1 testing.
31	DGND	Ground power supply pin connected to common (digital ground).
32	AGND	Common input sense line. No current flow (analog ground).
33	CLAMP	Op amp output voltage for Q2 clamp transistor base drive.
34	AMPS	Shunt resistor sense pin. Unused in Fluke Series 10.
35	ISRC	Current source pin for continuity, ohms, and capacitance.
36	SWS	Slide-switch position sense pin. Internal pull down.
37	OHMS	Ohms sense resistor input pin. Sense voltage at J2.
38	VSS	Negative power supply voltage (-3V relative to DGND).
39	ACV	AC volts input pin from 10 MΩ resistor.
40	APV0	DC volts input pin from 10 MΩ resistor.
41	DIVLO	Input divider (Z1) common (low) pin.
42	APV1	10-to-1 voltage divider and 1 MΩ reference resistor input.
43	APV2	100-to-1 voltage divider and 100 kΩ reference resistor input.
44	APV3	1000-to-1 voltage divider and 10 kΩ reference resistor input.

Table 2-2. U1 Pinout Table (cont)

Pin No.	Pin Name	Description
45	APV4	10,000-to-1 voltage divider and 1 kΩ reference resistor input.
46	DGND	Ground power supply pin connected to common (digital ground).
47	DATA3	Most significant bidirectional data bus line.
48	DATA2	Bit 2 of parallel data bus.
49	DATA1	Bit 1 of parallel data bus.
50	DATA0	Least significant bidirectional data bus line.
51	N/C	No connection.
52	BEEPER(L)	One of two beeper drive lines. Voltage swings VDD to VSS.
53	VSS	Negative power supply line (-3V relative to DGNG).
54	VSS	Negative power supply line (-3V relative to DGNG).
55	CLK	System clock line from U2. 131,072 Hz.
56	BCLK	Beeper frequency (2.3 kHz) clock line from U2.
57	TESTCLK	Test clock pin for U1 testing.
58	BEEPER	One of two beeper drive lines. Voltage swings VDD to VSS.
59	N/C	No connection.
60	WRITE(L)	When driven low (VSS), data is written to addressed register.

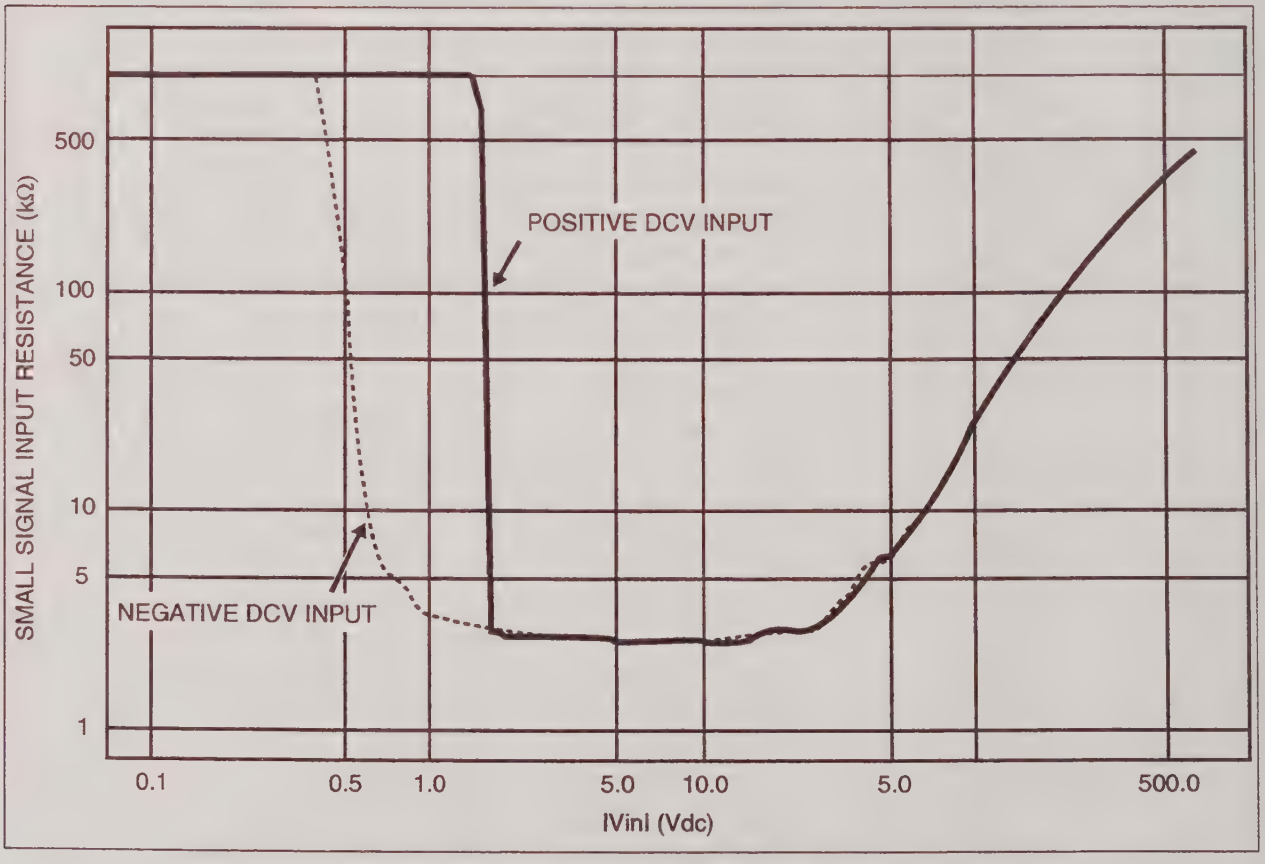
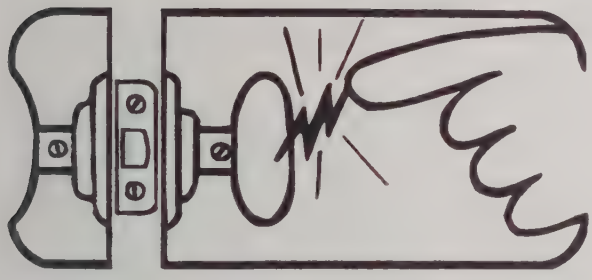


Figure 2-1. Typical VCHEK Input Resistance with DC Volts Function Selected

static awareness

A Message From
Fluke Corporation



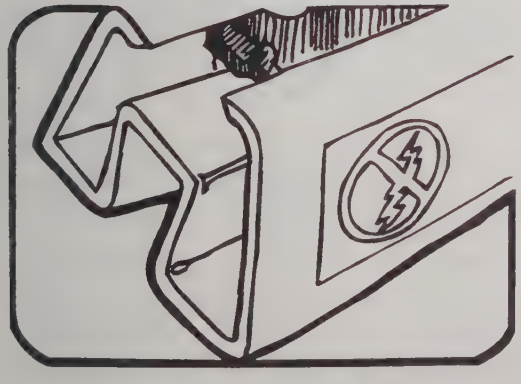
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Leaning the guidelines for handling them.
3. Using the procedures, packaging, and bench techniques that are recommended.

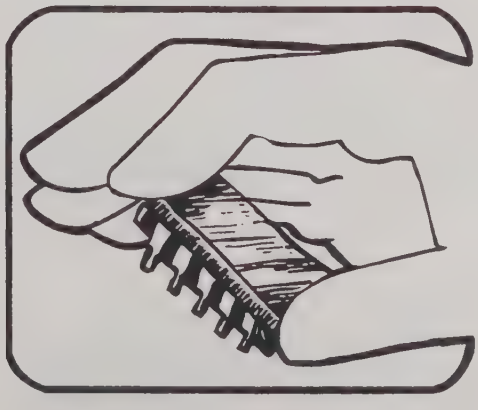
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.

1. MINIMIZE HANDLING

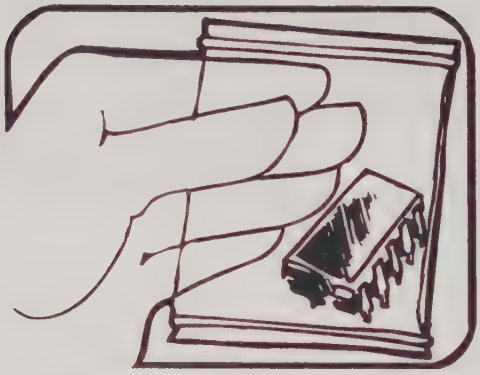
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



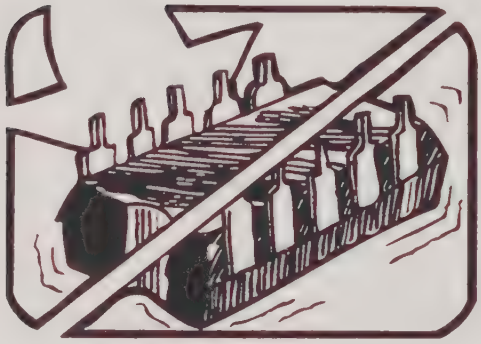
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



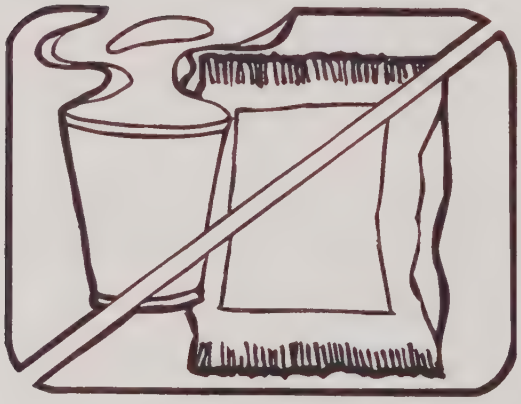
4. HANDLE S.S. DEVICES BY THE BODY.



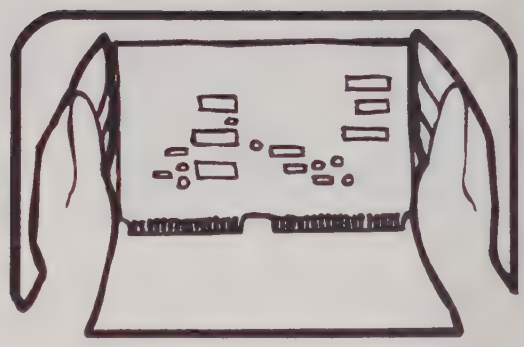
5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.



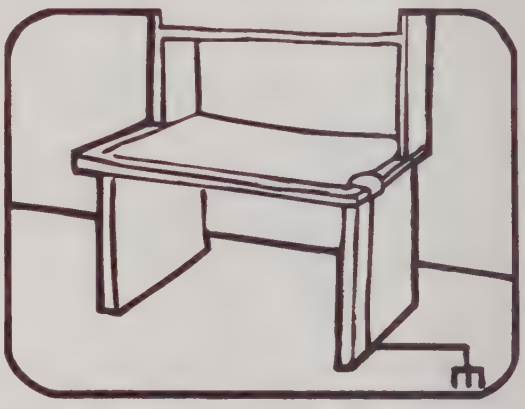
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA.



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION.

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

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Section 3
Maintenance

INTRODUCTION 3-1.

Section 3 covers the following:

- Disassembly and reassembly
- Cleaning
- Performance tests
- Calibration

DISASSEMBLY AND REASSEMBLY 3-2.

WARNING

TO AVOID ELECTRICAL SHOCK, REMOVE TEST LEADS AND ANY INPUT SIGNALS BEFORE OPENING THE CASE.

CAUTION

To avoid contamination from the fingers, handle the pca by the edges or wear gloves. PCA contamination can cause failures in humid environments.

This meter contains components that can be damaged by static discharge. To avoid damaging these components when servicing the meter, take precautions indicated on the "Static Awareness" at the beginning of Section 3.

Referring to Figure 3-1 as necessary, disassemble the meter as follows. A Phillips-head screwdriver and small flat-blade screwdriver are required.

1. Remove the test leads and set the slide-switch to OFF.
2. Remove the Phillips-head screws (H1-4) from the case bottom (MP8).
3. Separate the case top (MP2) from the case bottom.
4. TO REPLACE THE BATTERY: Lift the battery from the case bottom and insert a new 9V battery (NEDA 1604, 6F22, or 006P). Be sure the positive and negative battery posts are oriented correctly.
5. TO REMOVE THE PCA (A1): Insert a small, flat-blade screwdriver between the edge of the case top and the pca where shown in Figure 3-2. Gently unsnap a side of the case top from the pca. Repeat on the other side of the pca. Unsnap the case from the top of the pca last.
6. LIFT THE PCA FROM THE CASE TOP BY ITS EDGES. If the elastomeric contact strips (J3, J4) for the switch assembly (S2) and LCD (U3) are stuck to the pca, remove them without touching the conductive edges.

   TO REINSERT THE PCA: Important: First make sure that the slide-switch actuator (MP5) and slide-switch (S1) are both in the OFF position. Place the pca over the four screw posts in the case top, then press gently on the center of the pca while using the small flat-edge screwdriver to shoehorn the pca under the snap on a side of the case top. Repeat on the other side and the top.
7. TO REMOVE THE SWITCH SUPPORT (MP6): Hold the case top with the face of meter in your palm and press on the slide-switch actuator (MP5) to dislodge the switch support. Lift out the switch support.
8. The LCD, switch assembly, slide-switch actuator, and elastomeric contact strips (J3, J4) for the LCD and switch assembly are accessible and can be replaced as needed. Do not allow the LCD to get wet. Before installing a new LCD, make sure that all connector contact points are clean.

CAUTION

Do not touch the conductive edges of the elastomeric strips or the contacts on the switch assembly. If they are contaminated, clean them with isopropyl alcohol.

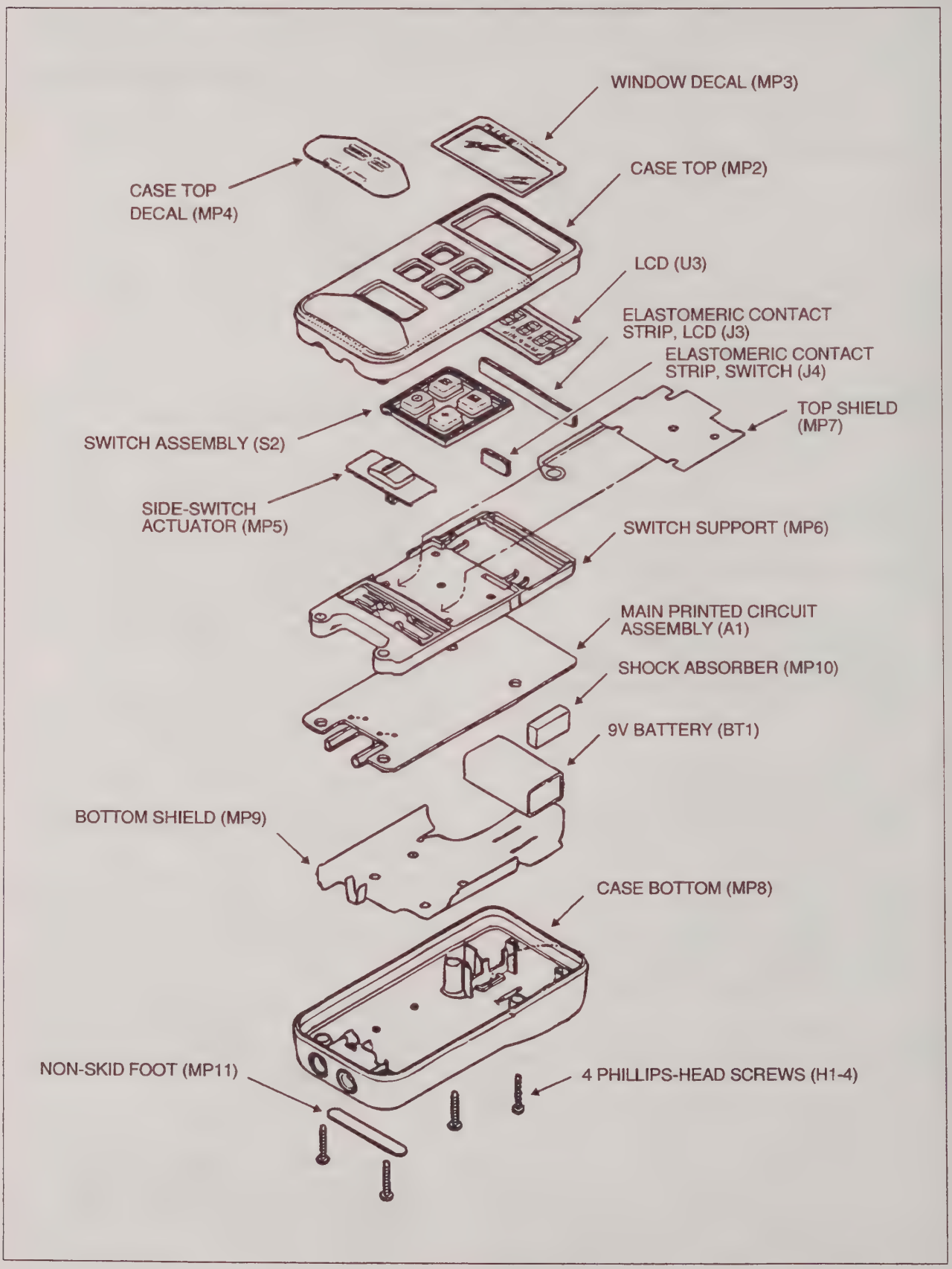


Figure 3-1. Disassembled Unit

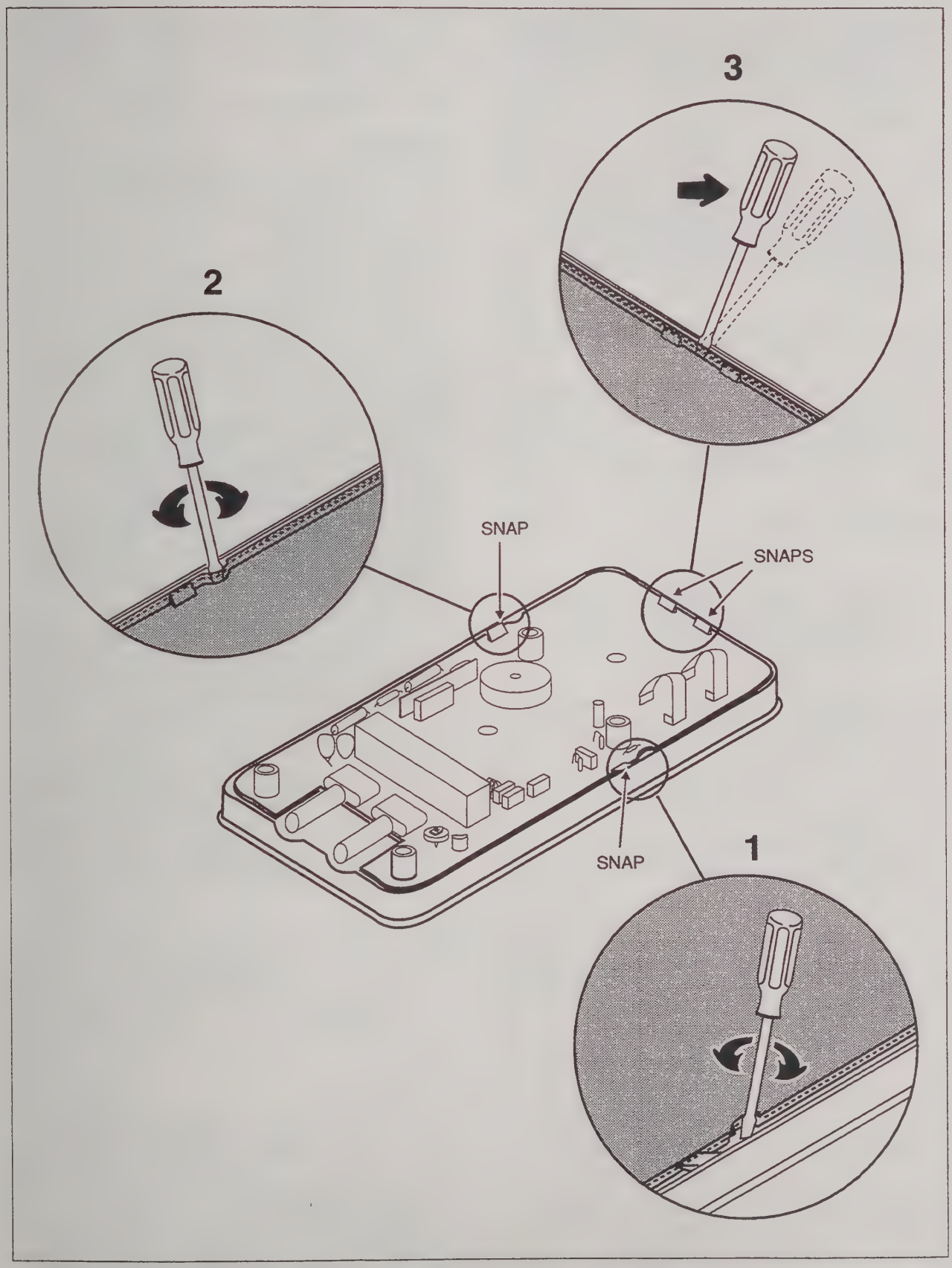


Figure 3-2. Removing and Reinserting the Printed Circuit Assembly

9. Reassembling the meter is the reverse of disassembling it. After the meter is reassembled, execute the PERFORMANCE TESTS to confirm that the meter is working properly.

CLEANING 3-3.

CAUTION

To avoid damaging the meter, do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastics used in the instruments. Do not get the LCD wet.

To clean the case, wipe it with a cloth lightly dampened with water and a mild detergent.

Wash the pca with isopropyl alcohol or hot deionized water and a soft brush. Do not use detergent of any kind for cleaning the pca. The pca must be completely dry before the meter is reassembled. Dry the pca with clean dry air at low pressure (<20 psi), then bake it at 50°C for 2 hours.

PERFORMANCE TESTS 3-4.

WARNING

TO AVOID SHOCK, DO NOT EXECUTE THE PERFORMANCE TESTS PROCEDURES UNLESS THE METER IS FULLY ASSEMBLED.

Use the PERFORMANCE TESTS to confirm that the meter is working properly. If the meter fails any of these tests, it needs calibration (see CALIBRATION) or repair. The equipment required is specified in Table 3-1.

1. Connect the calibrator to the [+] and COM jacks on the Meter.
2. Referring to Table 3-2 for the Fluke 10 or Table 3-3 for the Fluke 11 or 12, put the meter in the function and range shown for test 1.
3. Apply the input from the appropriate source. The reading on the display should be within the MINIMUM and MAXIMUM values shown in Table 3-2 or 3-3.
4. Test the remaining functions and ranges.

CALIBRATION 3-5.

To ensure that the meter performs to specifications, calibrate it annually using the following procedure:

1. Set the calibrator for 0V dc. Put the meter in the 4.000V dc range.
2. Connect the calibrator to the [+] and COM jacks on the Meter.
3. Apply an input of +4.000V dc ±0.25%

   The meter display should read between 3.997-4.003V. If it does not, adjust R4 (see Figure 3-3) as follows.

To adjust R4:

1. Remove any input signals to the meter.
2. Remove the four screws on the back and separate the case bottom and case top.

   Notice that when you do so the battery remains in the case bottom and power to the meter is disconnected.
3. Observing correct polarity, connect a 9V battery to the battery contacts using easy hook jumpers or alligator clip leads (see Figure 3-3).

NOTE

To avoid stretching or bending the battery contacts, connect leads to the base of the contacts as shown in Figure 3-3.

4. Set the calibrator for 0V dc. Put the meter in the 4.000V dc range.
5. Connect the calibrator to the [+] and COM jacks on the Meter.
6. Apply an input of +4.000V dc ±0.25%
7. Adjust R4 (see Figure 3-3) so that the meter display reads between 3.997-4.003V.

Table 3-1. Required Equipment

Equipment	Minimum Specifications	Recommended Model
DMM Calibrator	DC Voltage: 0-600V Accuracy: ±0.25% AC Voltage: 0-600V Accuracy: ±0.5% Frequency: 50-400 Hz	Fluke Models (5700A, 5100B, or equivalent)
Decade Resistor	Resistance: 1.0-40 MΩ Accuracy: ±0.25%	General Resistance RDS-77B and 41B
Decade Capacitor	Capacitance: 0-1.000 µF Accuracy: ±0.5%	GenRad 1412-BC

Table 3-2. Performance Tests for Fluke 10

Test No.	Meter Range	Input To Meter	Slide-Switch Position	Display Minimum	Display Maximum
1	4.000V AC	0V	Center	0.000	0.003
2	4.000V AC	10 mV, 50 Hz	Center	0.007	0.013
3	4.000V AC	10 mV, 400 Hz	Center	0.007	0.013
4	4.000V AC	3.5V, 50 Hz	Center	3.395	3.605
5	4.000V AC	3.5V, 400 Hz	Center	3.395	3.605
6	40.00V AC	35V, 50 Hz	Center	33.95	36.05
7	40.00V AC	35V, 400 Hz	Center	33.95	36.05
8	400.0V AC	350V, 80Hz	Center	339.5	360.5
9	600V AC	600V, 400Hz	Center	580	620
10	4.000V DC	0V	Center	0.002	0.002
11	40.00V DC	+20 mV DC	Center	00.01	00.03
12	400.0V DC	-200 mV DC	Center	-000.3	-000.1
13	4.000V DC	+3.5V	Center	+3.445	+3.555
14	40.00V DC	-35V DC	Center	-35.54	-34.46
15	400.0V DC	+100V DC	Center	+98.4	+101.6
16	600V DC	-600V DC	Center	-610	-590
17	Continuity	+2V DC	Right	1.968	2.032
18	400.0Ω	0.0Ω	Right	0.0	0.2
19	400.0Ω	1.0Ω	Right	0.8	1.2
20	400.0Ω	350.0Ω	Right	344.5	355.5
21	4.000 kΩ	1.0 kΩ	Right	0.984	1.016
22	40.00 kΩ	35 kΩ	Right	34.46	35.54
23	400.0 kΩ	100 kΩ	Right	98.4	101.6
24	4.000 MΩ	2.9 MΩ	Right	2.855	2.945
25	40.00 MΩ	35 MΩ	Right	34.30	35.70

Table 3-3. Performance Tests for Fluke 11 and 12

Test No.	Meter Range	Input To Meter	Slide-Switch Position	Display Minimum	Display Maximum
1	4.000V AC	0V	Center	0.000	0.003
2	4.000V AC,MIN MAX*	0V	Center	0.000	0.040
3	4.000V AC	10 mV, 50 Hz	Center	0.007	0.013
4	4.000V AC	10 mV, 400 Hz	Right	0.007	0.013
5	4.000V AC	3.5V, 50 Hz	Right	3.430	3.570
6	4.000V AC	3.5V, 400 Hz	Center	3.430	3.570
7	40.00V AC	35V, 50 Hz	Center	34.30	35.70
8	40.00V AC	35V, 400 Hz	Right	34.30	35.70
9†††	400.0V AC	350V, 80 Hz	Right	343.0	357.0
10	600V AC	600V, 400 Hz	Center	586	614
11	4.000V DC,MIN MAX*	0V	Center	-0.012	0.012
12	4.000V DC	0V	Right	-0.002	0.002
13	40.00V DC	+20 mV DC	Right	00.01	00.03
14	400.0V DC	-200mV DC	Center	-000.3	-000.1
15	4.000V DC	+3.5V	Center	+3.466	+3.534
16	40.00V DC	-35V DC	Center	-35.33	-34.67
17	400.0V DC	+100V DC	Center	+99.0	+101.0
18	600V DC	-600V DC	Center	-606	-594
19	Continuity	+2V DC**	Right	1.980	2.020
20	Continuity, VCHEK	+3.43V DC**	Right	3.397†	3.463†
21	Continuity, VCHEK	-0.5V DC**	Right	-0.507†	-0.493†
22	400.0Ω	0.0Ω	Right	0.0	0.2
23	400.0Ω	1.0Ω	Right	0.8	1.2
24	400.0Ω	350.0Ω	Right	346.6	353.4
25	4.000 kΩ	1.0 kΩ	Right	0.990	1.010
26	40.00 kΩ	35 kΩ	Right	34.67	35.33
27	400.0 kΩ	100 kΩ	Right	99.0	101.0
28	4.000 MΩ	2.9 MΩ	Right	2.873	2.927
29	40.00 MΩ	35 MΩ	Right	34.44	35.56
30	Ω, VCHEK	1.96V DC	Right	1.940†	1.980†
31††	1.000µF	0.0µF	Right	-0.001µF	0.001µF
32††	1.000µF	0.95µF	Right	0.93µF	0.970µF

* MIN MAX tests are for Fluke 12 only.

** Calibrator 50Ω divider override.

† The dc volts annunciator must be on.

†† Conducting performance tests of the 400Ω, 4 kΩ, 40 kΩ, and 1 µF ranges (tests no. 22, 23, 24, 25, 26, 31, and 32) verifies that the discrete and integrated circuitry needed to support the other capacitance ranges are working within specifications. Therefore, these tests indirectly verify that the meter will meet specification in the 10 µF, 100 µF, 1000 µF, and 10,000 µF ranges.

††† In the V-CHECK mode, the UUT uses a low-impedance thermistor (approx. 2.5 kΩ) for circuit protection and load testing (referred to as lo-Z input circuitry). When using the 5100B or 5700A to drive the UUT with higher voltages, avoid an overload/current limit condition by gradually stepping the voltage up (waiting two seconds between each step) from 90.0V, 120.0V, 180.0V and 350.0V at 80 Hz each step.

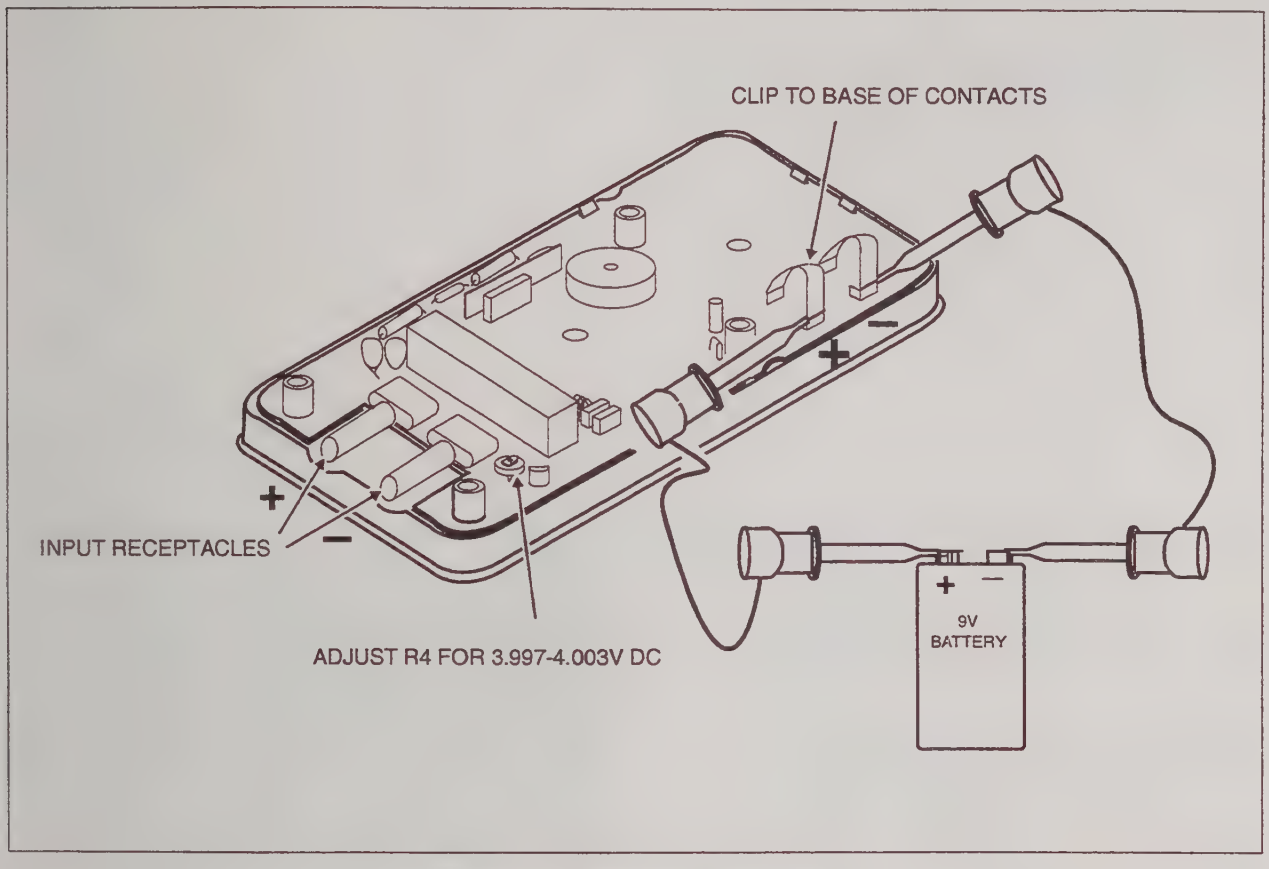


Figure 3-3. Calibration Adjustment

Section 4
Parts and Schematics

INTRODUCTION 4-1.

This section contains an illustrated list of replaceable parts and a schematic drawing for Series 10 Multimeters. Parts are listed by assembly; alphabetized by reference designator. Parts unique to a specific model are identified. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge.
- Description
- Fluke stock number
- Manufacturers supply code (code-to-name list at the end of this section)
- Manufacturers part number or generic type
- Total quantity
- Any special notes (i.e., factory-selected part)

CAUTION

A ϟ symbol indicates a device that may be damaged by static discharge.

HOW TO OBTAIN PARTS 4-2.

Electrical components may be ordered directly from the manufacturer by using the manufacturers part number, or from the John Fluke Mfg. Co., Inc. and its authorized representatives by using the part number under the heading FLUKE STOCK NO. In the U.S., order directly from the Fluke Parts Dept. by calling 1-800-526-4731. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacement Parts Catalog which is available on request.

In the event that the part ordered has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt delivery of the correct part, include the following information when you place an order:

- Instrument model and serial number
- Description (as given under the DESCRIPTION heading)
- Quantity
- Reference designator
- Part number and revision level of the pca containing the part.
- Fluke stock number

SCHEMATICS 4-3.

Figures 4-3 through 4-5 are schematics of the Series 10 Multimeters.

WARRANTY AND SERVICE CENTERS 4-4.

The Series 10 Multimeters are warranted for two years. The warranty is printed behind the title page of this manual. For service information, in the USA call 1-800-825-9810. Outside the USA, contact a Fluke service center. A list of service centers is at the end of Section 4.

NOTE

This instrument may contain a Nickel-Cadmium battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler. Contact your authorized Fluke service center for recycling information.

WARNING

THIS INSTRUMENT CONTAINS A FUSIBLE RESISTOR (PN 887034). TO ENSURE SAFETY, USE EXACT REPLACEMENT ONLY.

Table 4-1. 10/11/12 Final Assembly

REFERENCE DESIGNATOR	DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
BT 1	BATTERY,9V,0-15MA	696534	59717	216	1	
H 1- 4	SCREW,PH,P,THD FORM,STL,5-14,.750	832246		COMMERCIAL	4	
J 3	CONN,ELASTOMERIC,LCD TO PWB,2.050 L	867247	0K392	867247	1	
J 4	CONN,ELASTOMERIC,SWITCH TO PWB,.500 L	867242	0K392	867242	1	
MP 2	CASE,TOP		89536		1	1
MP 3	DECAL,WINDOW		89536		1	2
MP 4	DECAL,CASE TOP		89536		1	3
MP 5	ACTUATOR,SWITCH	879023	89536	879023	1	
MP 6	SUPPORT,SWITCH	879031	89536	879031	1	
MP 7	SHIELD,TOP (FORMED)	899380	89536	899380	1	
MP 8	CASE,BOTTOM		89536		1	4
MP 9	SHIELD,BOTTOM		89536		1	4
MP 10	SHOCK ABSORBER	878983	89536	878983	1	
MP 11	FOOT, NON-SKID	885884	89536	885884	1	
MP 12	TEST LEADS	855742	89536	855742	1	
MP 13	DECAL, WARNING (FOREIGN LANGUAGE)	897843	89536	897843	1	
S 2	SWITCH ASSEMBLY		89536		1	5
TM 1	USERS MANUAL, ENGLISH FLUKE-10	900196	89536	900196	1	
TM 2	USERS MANUAL, ENG/INTL, FLUKE-10	900204	89536	900204	1	
TM 3	UERSS MANUAL, ENGLISH FLUKE 11/12	900191	89536	900191	1	
TM 4	USERS MNL,GER/ITA/JPN,FL-11/12	900209	89536	900209	1	
TM 5	USERS MNL,ENG/FRN/SPN,FL-11/12	900212	89536	900212	1	
U 3	LCD,3.5 DIGIT,MULTIPLEXED	855226	62786	855226	1	

NOTES:

ϟ Static sensitive part.

1. FOR FLUKE MODEL 10 ORDER FLUKE STOCK NUMBER 879015
   FOR FLUKE MODEL 11 ORDER FLUKE STOCK NUMBER 879010
   FOR FLUKE MODEL 12 ORDER FLUKE STOCK NUMBER 879007
2. FOR FLUKE MODEL 10 ORDER FLUKE STOCK NUMBER 890442
   FOR FLUKE MODEL 11 ORDER FLUKE STOCK NUMBER 890447
   FOR FLUKE MODEL 12 ORDER FLUKE STOCK NUMBER 890343
3. FOR FLUKE MODEL 10 ORDER FLUKE STOCK NUMBER 890467
   FOR FLUKE MODEL 11 & 12 ORDER FLUKE STOCK NUMBER 890335
4. ORDER BOTTOM CASE (BOTTOM SHIELD) ASSEMBLY FLUKE STOCK NUMBER 899385.
5. FOR FLUKE MODEL 10 ORDER FLUKE STOCK NUMBER 874730
   FOR FLUKE MODEL 11 ORDER FLUKE STOCK NUMBER 874727
   FOR FLUKE MODEL 12 ORDER FLUKE STOCK NUMBER 874722

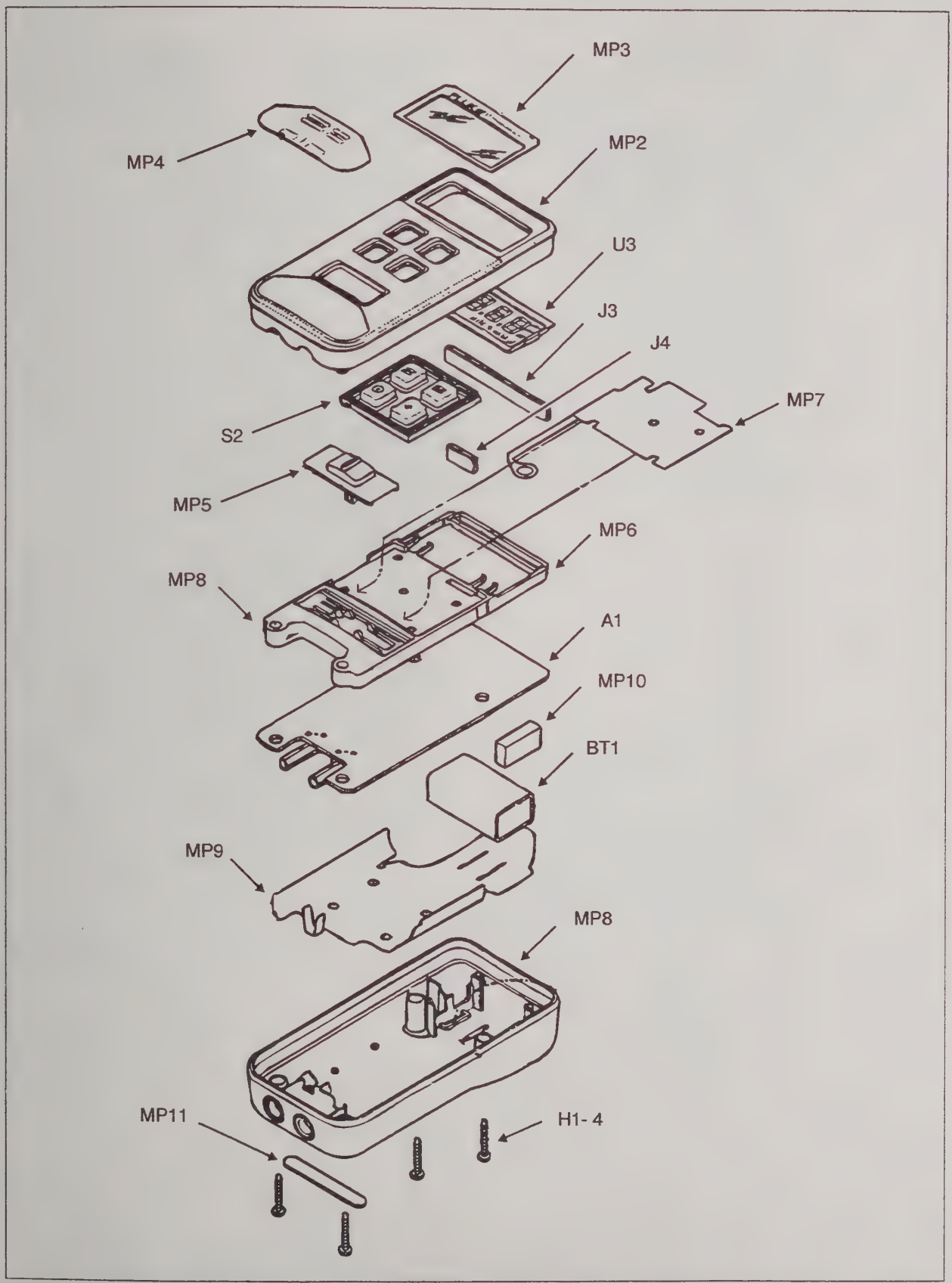


Figure 4-1. Final Assembly Drawing

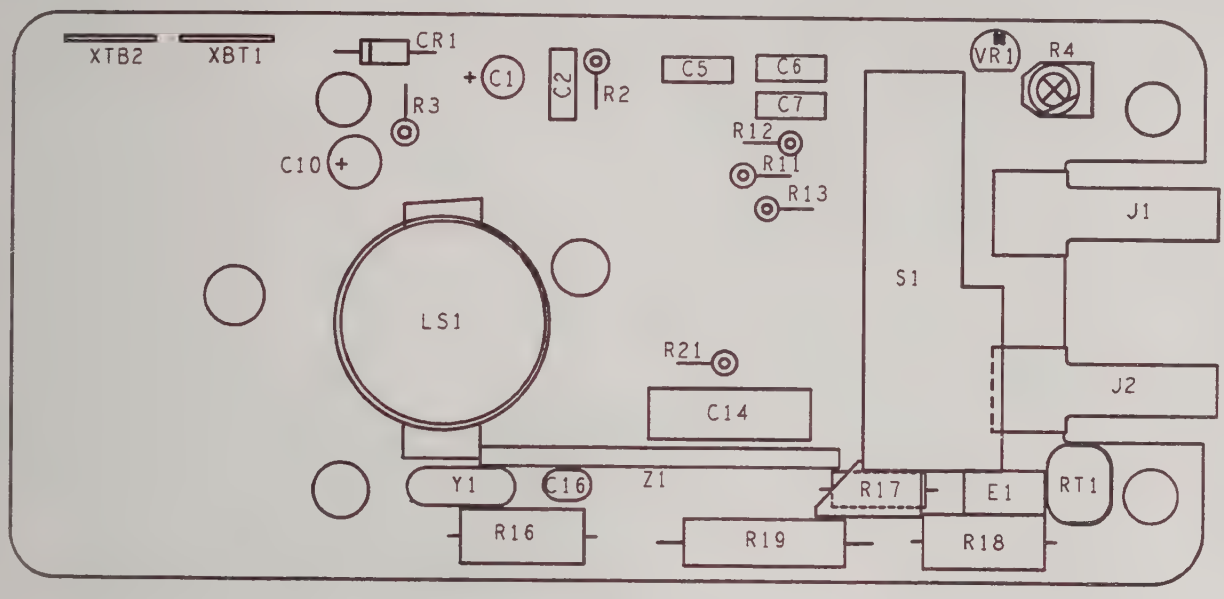
Table 4-2. A1 Main PCA

REFERENCE DESIGNATOR		DESCRIPTION	FLUKE STOCK NO	MFRS SPLY CODE	MANUFACTURERS PART NUMBER OR GENERIC TYPE	TOT QTY	NOTES
C 1		CAP,TA,0.47UF,+-20%,35V	655035	56289	199D474X0035AG2	1	
C 2, 5- 7		CAP,POLYES,0.022UF,+-10%,50V	715268	37942	185-2-223K50AA	4	
C 3		CAP,TA,22UF,+-20%,6V,6032	876545	56289	293D226X06R3C2T	1	
C 4, 11, 13		CAP,CER,0.1UF,+-10%,25V,X7R,1206	747287	04222	12063C104KAT060B		1
C 8		CAP,TA,3.3UF,+-20%,16V,3528	876552	56289	293D335X0016B2T	1	
C 9		CAP,CER,0.022UF,+-10%,50V,X7R,1206	747279	04222	12065C223KAT060B	1	
C 10		CAP,AL,22UF,+-20%,10V,SOLV PROOF	887245	62643	KRG10VB22RM4X7RP	1	
C 14		CAP,POLYES,0.01UF,+-10%,1000V	822361	68919	MKS4.01/1000V/10	1	2
C 15		CAP,TA,47UF,+-20%,10V,7343	867580	89536	867580	1	
C 16		CAP,CER,10PF,+-20%,50V,C0G	721589	04222	SR595A100MAA	1	
CR 1		DIODE,SI,100 PIV,1.0 AMP	912451	04713	1N4002	1	
CR 2	ϟ	DIODE,SI,DUAL,BV=50V,IO=100MA,SOT23	851659	04713	MBAV74T1	1	
CR 3	ϟ	DIODE,SI,BV=70.0V,IO=50MA,DUAL,SOT23	742320	8A233	BAV99	1	
E 1		SURGE PROTECTOR,3750V,+-20%	867361	91984	100-HT1	1	
J 1, 2		RECEPTACLE,INPUT	878988	89536	878988	2	
LS 1		AF TRANSD,PIEZO,20MM	876995	59096	KBS-20DB-2T-5	1	
Q 1	ϟ	TRANSISTOR,SI,NPN,SELECT IEBO,SOT-23	821637	04713	SMBT1388LT1	1	
Q 2	ϟ	TRANSISTOR,SI,PNP,SELECT ICER,SOT-23	887179	04713	SMBT1531LT1	1	
R 1	ϟ	RES,CERM,162K,+-1%,.125W,100PPM,1206	876198	91637	CRCW1206-1623FB	1	2
R 2		RES,MF,332K,+-1%,0.125W,100PPM	655217	59124	MF50D3323F	1	
R 3		RES,MF,23.4K,+-0.1%,0.125W,100PPM	876292	59124	MF50D2342B	1	
R 4		RES,VAR,CERM,25K,+-25%,0.2W	876300	80294	3306P-1-253	1	
R 5		RES,CERM,43.2K,+-1%,.125W,100PPM,1206	887109	91637	CRCW1206-4322FB	1	
R 6	ϟ	RES,CERM,226K,+-1%,.125W,100PPM,1206	876524	91637	CRCW1206-2263FB	1	
R 7- 9, 23, R 28	ϟ	RES,CERM,1M,+-1%,.125W,100PPM,1206	836387	91637	CRCW1206-1004FB	5	
	ϟ		836387				
R 10	ϟ	RES,CERM,309K,+-1%,.125W,100PPM,1206	876201	91637	CRCW1206-3093FB	1	
R 11, 12		RES,MF,30.1K,+-0.1%,0.125W,100PPM	887161	59124	MF50D3012B	2	
R 13		RES,MF,27.1K,+-0.1%,0.125W,100PPM	876289	59124	MF50D2712B	1	
R 14, 15	ϟ	RES,CERM,10K,+-5%,.125W,200PPM,1206	746610	91637	CRCW1206-1002JB	2	
R 16, 18	ϟ	RES,CERM,470,+-5%,3W,100PPM	887117	23237	GS-3-470-5%	2	2
R 17	ϟ	RES,CERM,1M,+-5%,1W	655175	19647	MS214-105-5%-200PPM/C	1	2
R 19		RES,MF,500,+0,-20%,100PPM,FLMPRF,FUS	887034	91637	CMF-65 89-4500K T-1	1	2
R 20, 27	ϟ	RES,CERM,0,+.05 MAX,.125W,1206	810747	91637	CRCW1206-0R00B	2	2
R 21		RES JUMPER,0.02,0.25W	682575	91637	FRJ-55	1	
R 22, 29	ϟ	RES,CERM,300,+-5%,.125W,200PPM,1206	746362	91637	CRCW1206-3000JB	2	
R 24		RES,CERM,487K,+-1%,.125W,100PPM,1206	887112	91637	CRCW1206-4873FB	1	
R 25	ϟ	RES,CERM,2.2M,+-5%,.125W,200PPM,1206	811778	91637	CRCW1206-2204JB	1	
R 26	ϟ	RES,CERM,100K,+-1%,.125W,100PPM,1206	769802	91637	CRCW1206-104FB	1	
RT 1		THERMISTOR,POS,1.1K,+-20%,25 C	867192	54583	911P67E112MW07	1	
S 1		SWITCH,SLIDE,3 POSITION,5 PIN	868117	79727	868117	1	
U 1		ARTIC, ASSEMBLY TESTED	858472	89536	858472	1	
U 2	ϟ	IC,CMOS,4 BIT MPU,LCD CNTRLR,80PN QFP	866913	33297	UPD75304GF-XXX-3B9	1	
VR 1	ϟ	IC, 1.23V,150 PPM T.C.,BANDGAP V. REF	634451	12040	LM385Z-1.2D26Z	1	
XBT 1, 2		CONTACT,BATTERY	897777	89536	897777	2	
Y 1		RESONATOR,CERAMIC,PIEZOELEC,2.10MHZ	876024	54583	FCR2.1MC3	1	
Z 1		RES NET THK FILM TESTED	872234	89536	872234	1	

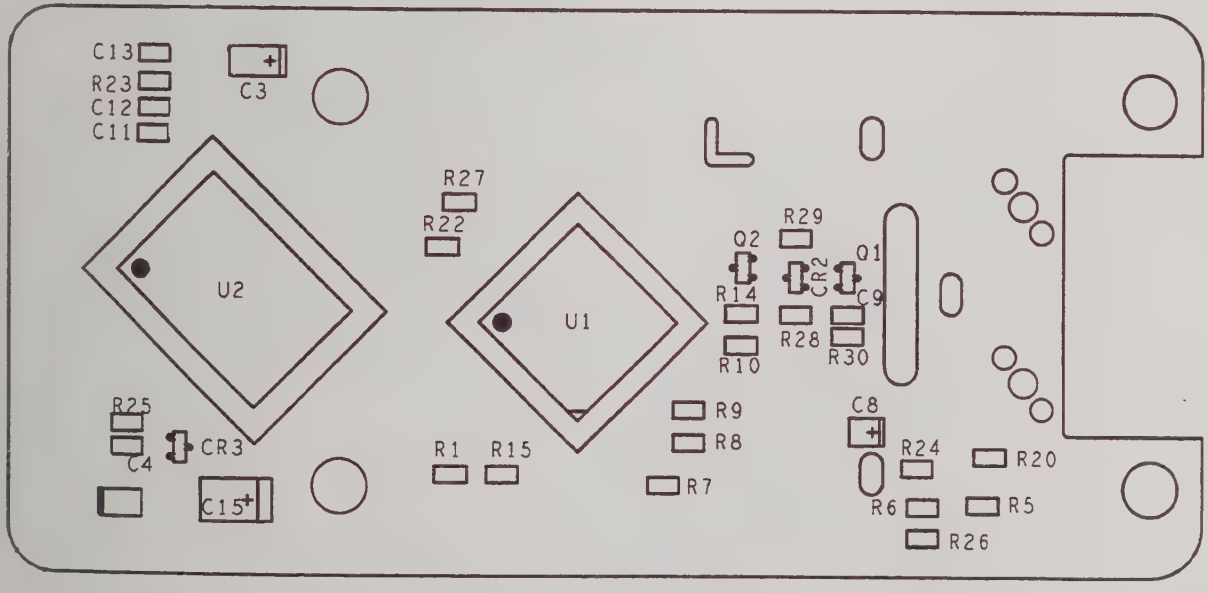
NOTES:

ϟ Static sensitive part.

1. FOR FLUKE MODEL 10 QTY = 3 C4,11,13
   FOR FLUKE MODEL 11 QTY = 3 C4,12,13
   FOR FLUKE MODEL 12 QTY = 2 C4,13
2. WARNING - SAFETY RELATED COMPONENTS, USE EXACT REPLACEMENT ONLY.



R.I./HANDSTUFFED SIDE



SURFACE MOUNT SIDE

Figure 4-2. A1 Main PCA Components

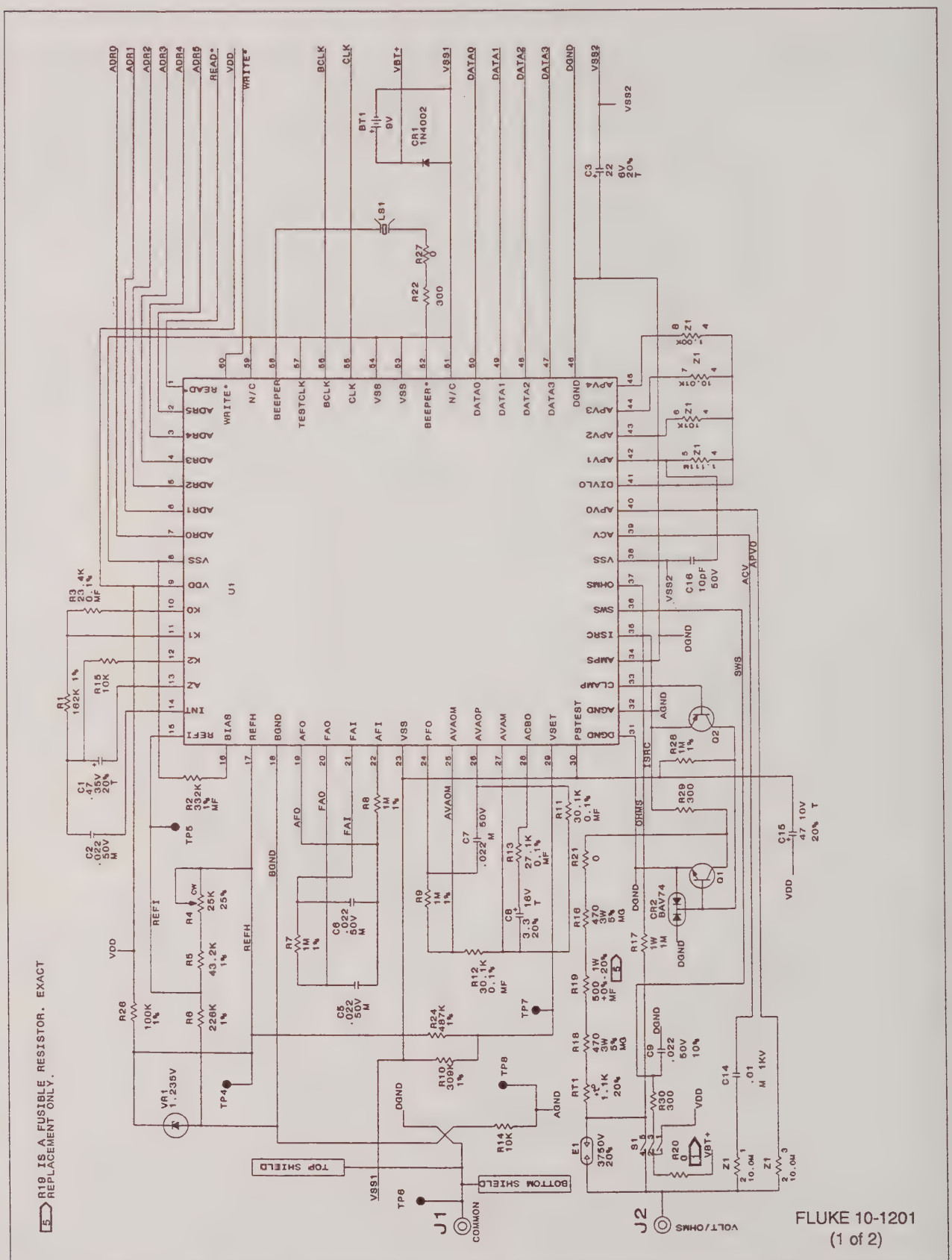


Figure 4-3. FLUKE 10 Schematic

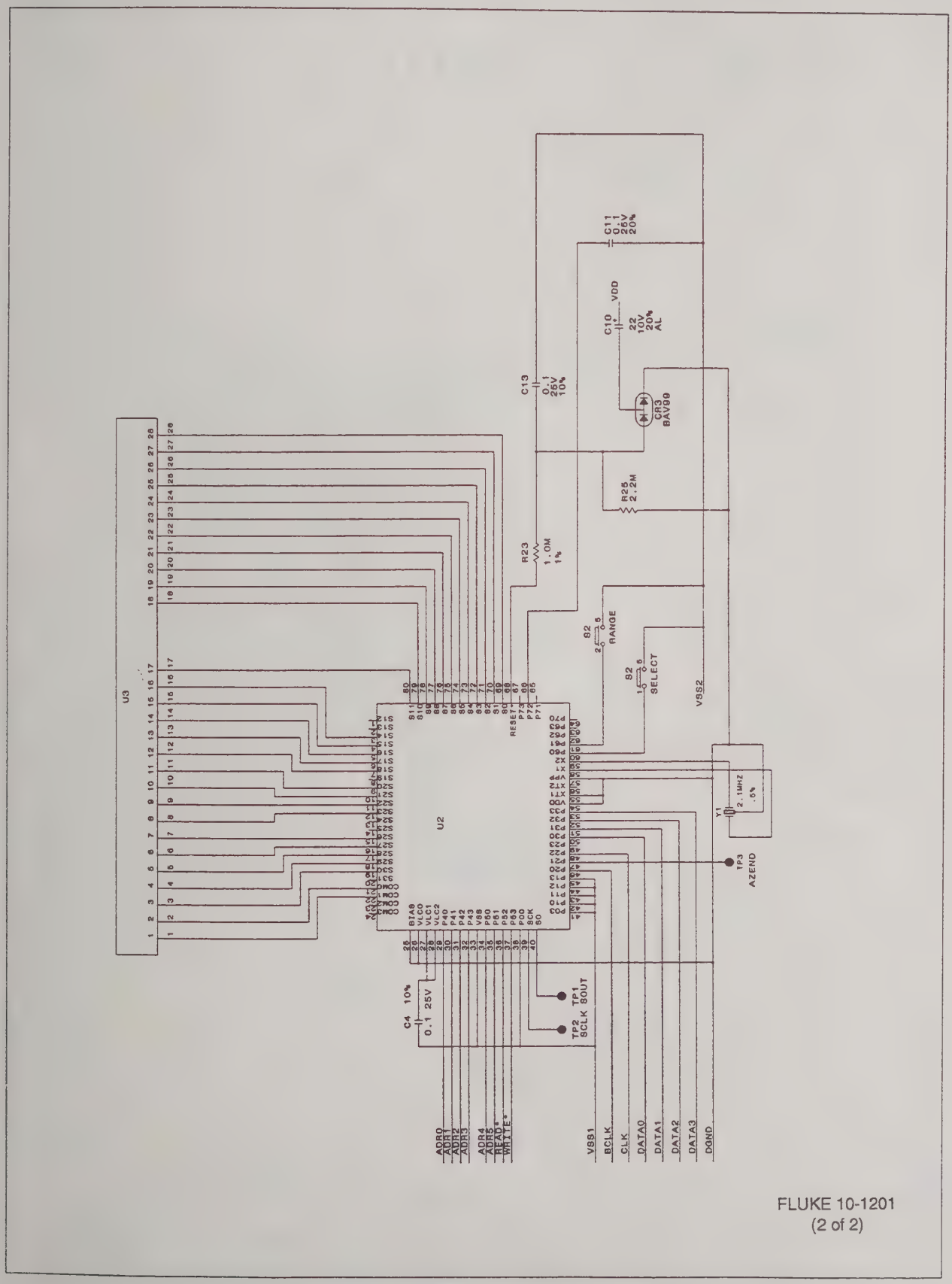


Figure 4-3. FLUKE 10 Schematic (cont)

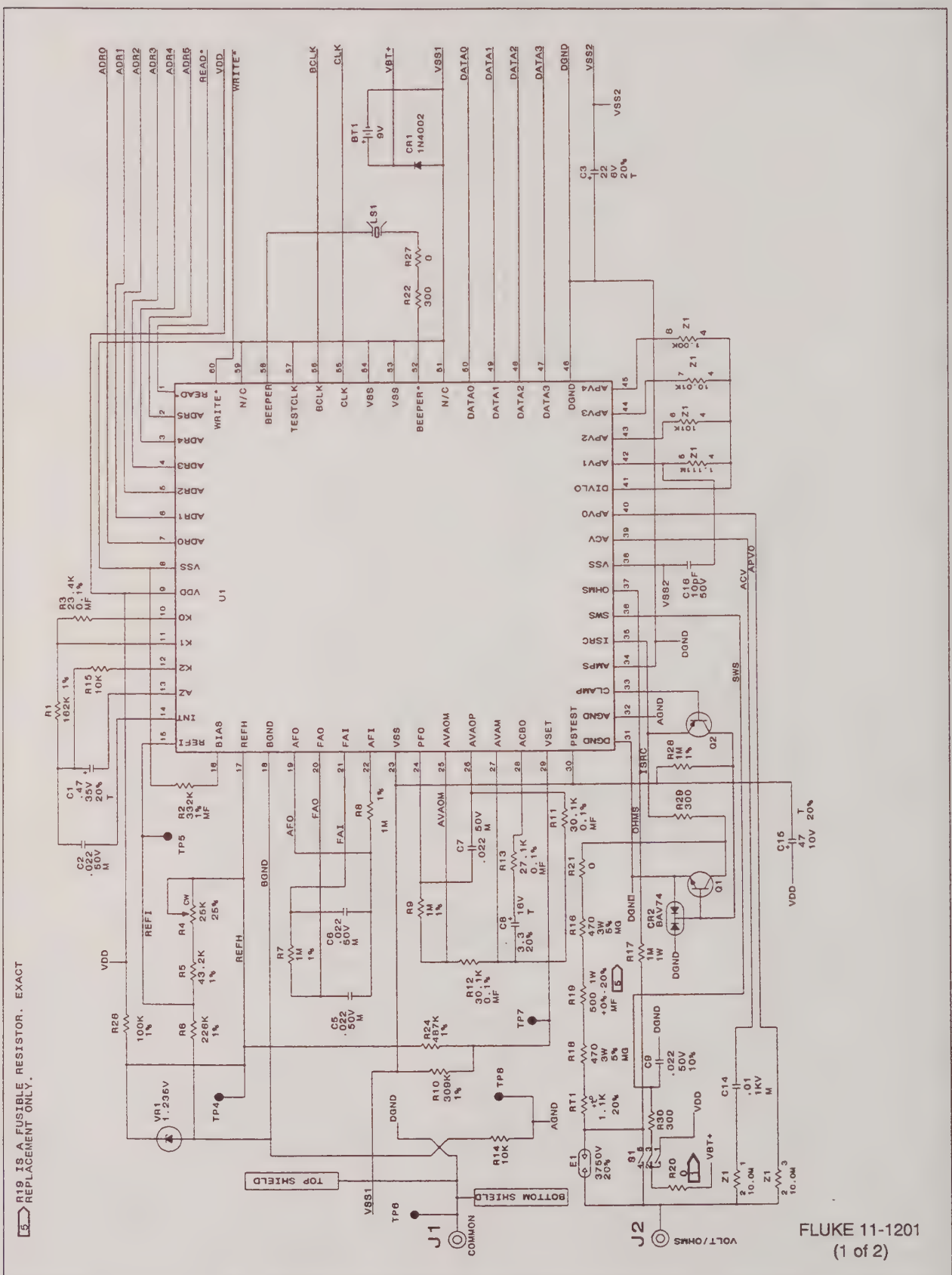


Figure 4-4. FLUKE 11 Schematic

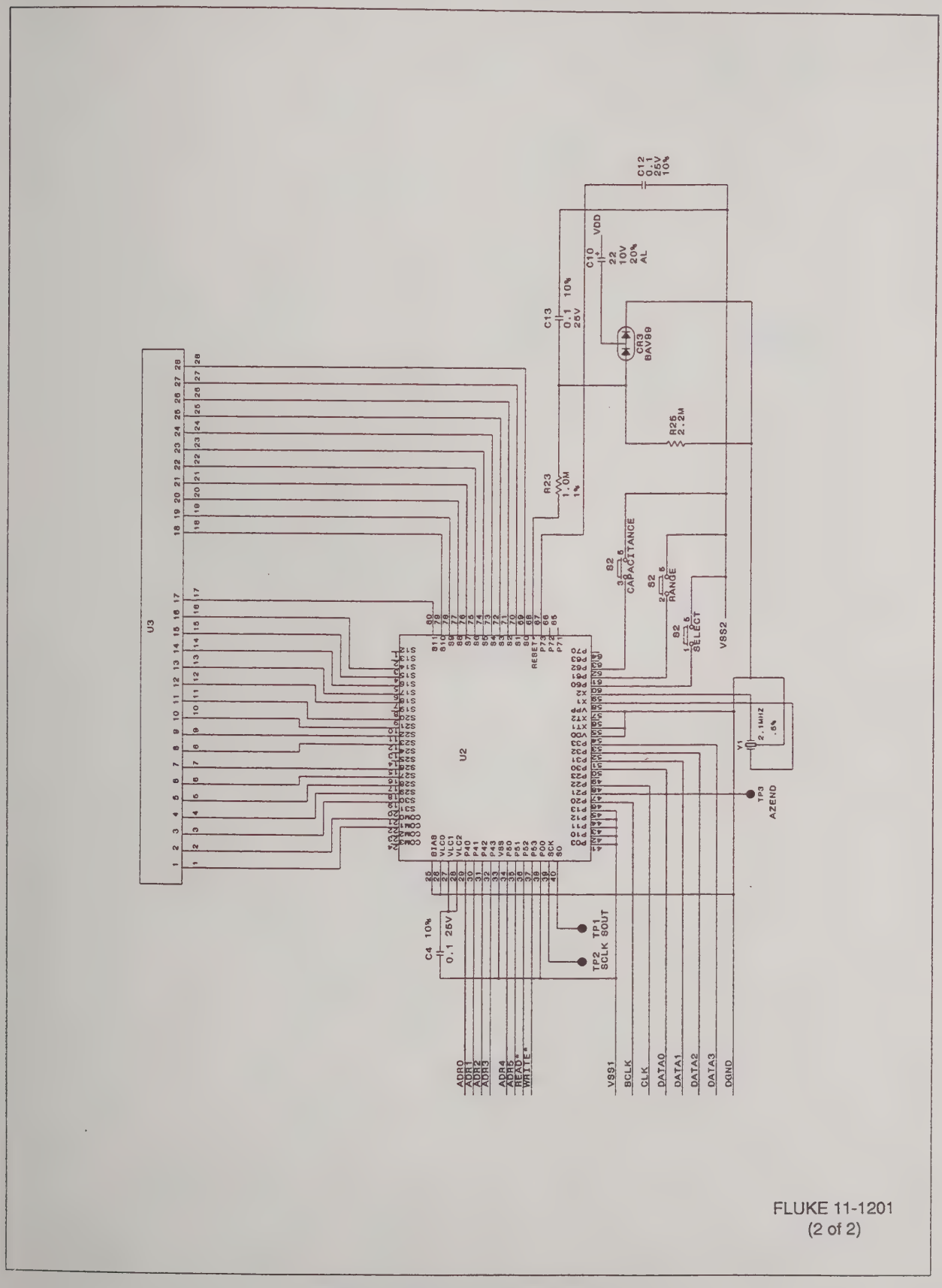


Figure 4-4. FLUKE 11 Schematic (cont)

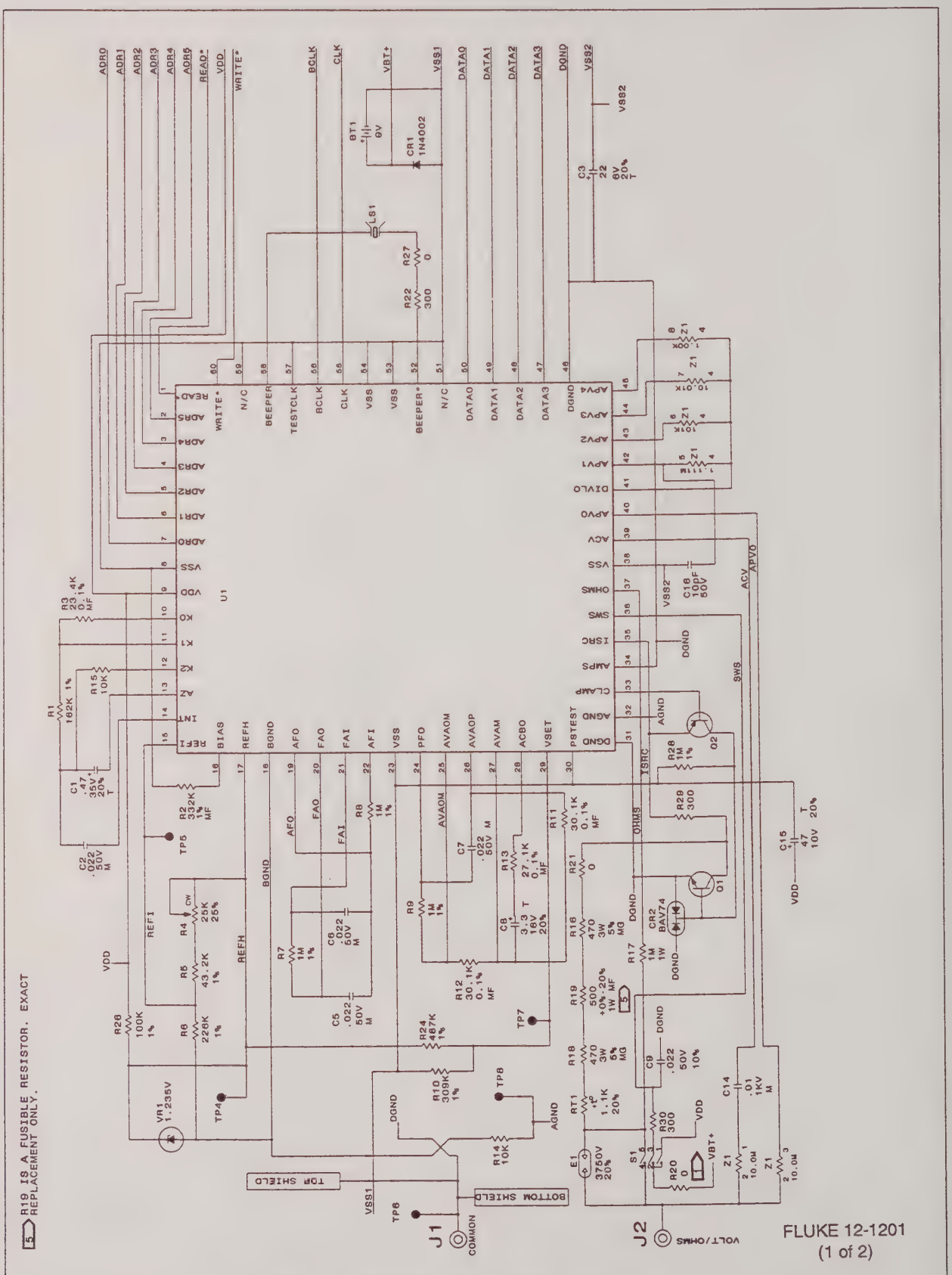
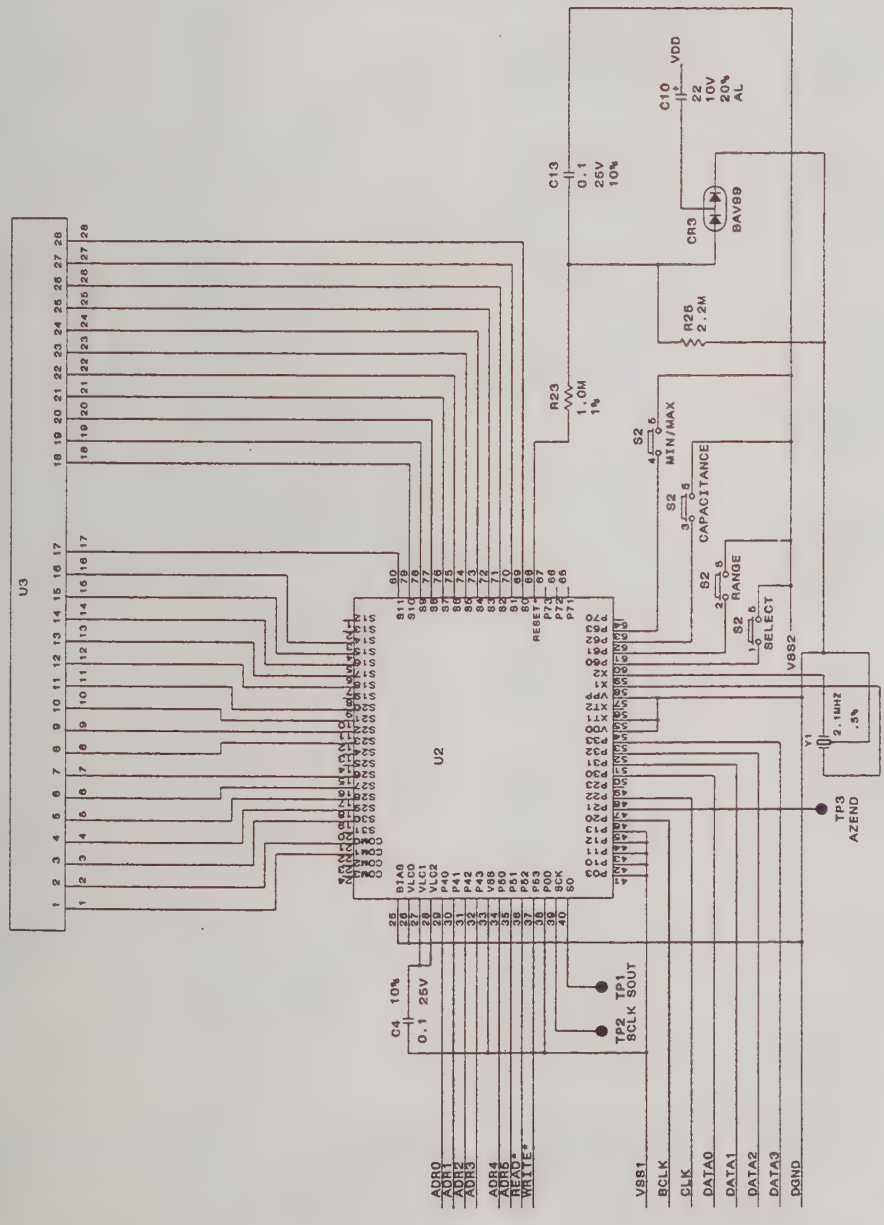


Figure 4-5. FLUKE 12 Schematic



FLUKE 12-1201
(2 of 2)

Figure 4-5. FLUKE 12 Schematic (cont)

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